# Weekly Report for 07/06/2015

## Highlights

• This is a three-week report. (Kathy Harkay)

• Presented talk on Injector requirements at the CD1 review with CY Yao, with input from R. Lindberg and J. Calvey. Participated in productive discussions with the CD1 review committee members. (Kathy Harkay)

## APS Renewal and Upgrade

• Checked BTS line layout with survey data. Found out the extraction/injection boundary condition assumed for the current BTS line design. (Aimin Xiao)

• Resubmit shot-to-shot injection simulation after fixing a small issues in previous run. (Aimin Xiao)

• Modified optics by adding collimators to the high dispersion area. Detail simulations will follow. (Aimin Xiao)

• Attended MBA Accelerator Physics meeting. (Jeff Dooling)

• Presented results on the PAR ion tune shift showing reasonable agreement between data and simulation. Continuing to refine these results by using different gas compositions. (Joe Calvey)

• Ran the ion simulation code for higher PAR charge. The simulation predicts the beam will be unstable at 6-8 nC, and 18-20 nC, but not for intermediate values. (Joe Calvey)

• Attended APS-U Physics meeting. (Kathy Harkay)

• Iterated on updates to Injector Requirements CD1 presentation, with feedback from G. Decker, M. Borland, and CY Yao. (Kathy Harkay)

• Provided feedback to M. Borland on his CD1 review talk. (Kathy Harkay)

• Participated in injector studies: PAR ion effects, booster chromaticity correction, and booster DC mode. (Kathy Harkay)

• Presented talk on Injector requirements at the CD1 review with CY Yao, with input from R. Lindberg and J. Calvey. Participated in lively and productive discussions with CD1 Director's review accelerator systems subcommittee on injector strategy. (Kathy Harkay)

# MCR Operations

## Linac Operations

• Working in L3119, installed and aligned Brewster-cut laser rods in the regen pump chambers. These heads use an aluminized-mylar film on the inner cover wall to improve pumping efficiency. (Jeff Dooling)

• Installed new Pockels Cell dual HV supply in the Laser Room and began regen alignment work. (Jeff Dooling)

• Worked with K. Belcher (AES-SI) on allowing low-power laser alignment light from the pcgun laser room through the ACIS gate valve shutter while in the linac is in Authorized Access mode using the new procedure, APS_1685105. (Jeff Dooling)

• Belcher found a problem in the process that he will address. (Jeff Dooling)

# APS Machine Studies

### Storage Ring Studies

• Double checked orbit switch after fixing par phase shifter error (Aimin Xiao)

• Summarized CPU experiment results. Conclusion: no better way to fix coupling variation from magnet's hysteresis. (Aimin Xiao)

• Presented SCU1 fast BLM calibration results from 7/5 at the Machine studies meeting. (Jeff Dooling)

• Conducted studies to calibrate the ID1/SCU1 inboard BLM, with J. Dooling. Used IK4 and a horizontal inboard 4-mm bump at ID1. (Kathy Harkay)

• Used Cu bar heaters in SCU0 to apply power to the vacuum chamber to simulate 130 mA, with C. Doose. Powered SCU0 with 650 A on the main coil, and stored 100 mA in 24 bunches. Adjusted the heaters to match the center chamber temperatures. The 4-K circuit cooling overhead was exceeded, which caused the LHe tank pressure to rise, but at about 3 Torr/h instead of 4.8 Torr/h measured with 130 mA. Discussed results with Yury; the missing power is from the chamber transitions. Presented results at weekly studies meeting. (Kathy Harkay)

### PAR Studies

• Measured tune shift along the PAR cycle with gated drive signal. Discovered that this leads to a much larger tune shift and tune spread than previously measured, presumably because more ions are trapped. Also measured tune signal as a function of drive length. (Joe Calvey)

• Blew up the vertical beam size in the PAR (through coupling) at low charge, and measured the effect on booster injection efficiency. Found that a larger beam does seem to lead to lower efficiency, even at low charge. (Joe Calvey)

### Linac Studies

• Worked on linac lattice set up for sending the electron beam through PAR and booster bypass,checked out diagnostics along the by pass beam line. (Yin-e Sun)

• Worked on setting up a reference file for sending 150 MeV beam to LTP beamline and observed beam on LTP:FL1 as a spectrometer screen. When the transverse mode cavity is installed, we will check the beam longitudinal profile at 150MeV and 375 MeV using the Tcav+LTP:B1 and LTP:FL1 (or a to-be installed flag close to this location) as the diagnostics tool. (Yin-e Sun)

## APS Machine Research and Development

### Storage Ring Research and Development

• Proposed multiple ionization as an explanation for why we don't observe ion instability in the present APS. Showed that the amplitude of the instability is very sensitive to pressure and gas composition. (Joe Calvey)

• Came up with a way to simulate 130 mA and confirm the equilibrium LHe tank pressure in a 6-8 hr study period. Otherwise the study requires up to 3 days during user operations, introducing a degree of risk. (Kathy Harkay)

• Continued discussions of radiation survey data needed for the abort kicker, with J. Dooling, J. Vacca, V. Sajaev. The dosimeter sensitivity is 2x below the "radiation area" designation for photons and 4x below for neutrons. Since the dosimeters came back "zero" after dumping 100 mA, we potentially have to dump 1200 mA = 4 x 100 mA x 3 to prove that 100 mA does not create a radiation area, up to max 3 MPS dumps in an hour. Shared my concerns that this is too many dumps, especially if we're restricted to 20 mA per dump. (Kathy Harkay)

### Linac Research and Development

• Completed LLRF measurement of 3G2 rf gun at the vacuum lab. and analyzed data. Found that at 128F the gun resonant at 2856MHz, with 0.200" shims and 25-20 W cathode heater power. Cathode torqued down with 0.6 inch lbs. torque. Instructed the ITS water station set to 128 F, 3G2 to be tune tested in the ITS this week. (Yin-e Sun)

• took data on the cathode activation on cathode heater power vs temperature, as well as vacuum info. (Yin-e Sun)

• Spend an afternoon in the laser room helping with photo-cathode drive-laser alignment. (Yin-e Sun)

• Worked on setting up elegant simulations to track particles through a deflecting cavity and optimize for best longitudinal phase space resolutions. (Yin-e Sun)

• Attended PiP meeting and reported on pc gun laser status. (Jeff Dooling)

### ITS Research and Development

• discussed experiment plan and collaborations with Colorado State University researcher on the thermionic cathode characteristics at the injector test stand. Provided data on the gun current monitor, cathode heater power and temperature measurements for aforementioned collaborator. (Yin-e Sun)

## Other Research and Development

• continued work on a double emittance exchanger simulation using GPT. Established a good lattice for double emittance exchange with a realistic transverse RF cavity field map (at 3.9 GHz). Initially beam size was too large at the 2nd exchanger Tcav location. Upon optimization of the initial beam phase space, the 2nd exchanger also works without space charge. (Yin-e Sun)

• However once including space charge, the deterioration is significant. Working on parameters to reduce space charge to a lesser degree. (Yin-e Sun)

# APS Machine Software

### Storage Ring

• fixed a SCR bug for SR xray bpm custom compare because of the string value of non-numerical pvs, 1) corrected the IsNumerical column for the non-numerical PVs and added filter to filter out the non-numerical PVs for custom compare. (Hairong Shang)

• added S27 xray bpm back to remove ID devices from default configs pem, and added checking the S27 inuse when steering ID27. (Hairong Shang)

• added -restoreVSA option to getxytunes to restore the tune setup of VSA for MXA-VSA tune measurement. (Hairong Shang)

• added "RESTORE VSA" button to SRDispChromMeas to restore VSA tune setup for MXA-VSA tune measurement. (Hairong Shang)

• improved SR ID pems and gap scan scripts for closing ID01 gaps, because ID01ds (SCU1) was tripped off when closing ID01us and hard to turn SCU1 back on without hardware people's help. modified so that 1)for closing ID01us, before closing ID01us, open ID01ds and turn it off 2)for closing ID01ds (SCU1), before closing ID01ds, open ID01us first and then turn ID01ds on. the pems and gap scans are ready for test. (Hairong Shang)

### Injectors

• improved Booster4CorrectorBumpScan so that the bump range is obtained from the RampTime of the default corrector ramp table. (Hairong Shang)

• added APSMpBoosterDCRampStandardize pem for starndardizing booster DC ramps, tested and installed (Hairong Shang)

• CY collected booster BSP100 bpm response data, however, the data was not correct for region 7 and 8, debugged and found that the bump start and bump end for region 7, and 8 are not in the ramp table, so that extra points were generated in the ramp table and caused the IOC refused to load the ramp table when the number of ramp points is greater than 21, so that no bumps were ever generated for region 7 and 8. Fixed the start/end bump for region 7 and 8, and collected the data which showed correct response. (Hairong Shang)

### General

• added catch statement to reading pv units and set the unit to empty string if error occurred in reading the units, and added pendIOtime to reading the units pv to avoid channel access errors, and added 30 seconds pendIOtime to all cavget commands to limit channel access errors. (Hairong Shang)

## Meetings, workshops, conferences, committees, LMS related, and reviews

• Attended the CD-1 Director's Review. Discussed ion trapping with reviewer M. Palmer. (Joe Calvey)

## Miscellaneous

• Took 1 day vacation off (Aimin Xiao)

• Helped outsider on elegant run issues (Aimin Xiao)